

36. (NEW) An apparatus for providing an output dependent on the orientation of a moving object relative to its direction of movement, comprising:

(a) light-reflective means carried with said object, said light-reflective means defining three reference locations of the object spaced from one another in said direction, and each of the three locations being displaced from alignment with the other two locations;

(b) detection means for defining a detection plane transverse to said direction for responding to movement of said light-reflective means through said plane, said detection means comprising:

(i) means for emitting light transversely of said direction for reflection within said plane from said locations during movement of said object through said plane; and

(ii) means responsive to the light reflected within said plane from said locations to provide electric signals in accordance with movement through said plane of the three locations respectively; and

(c) means responsive to said signals relative to one another for providing said output.

37. (NEW) The apparatus according to claim 36, wherein said means responsive to said signals is means responsive to the timing of said signals relative to one another.

38. (NEW) The apparatus according to claim 36, wherein said means responsive to said signals is means responsive to the relative timing of said signals to provide representation of speed of movement and orientation of said object.

39. (NEW) The apparatus according to claim 36, wherein said means for emitting light is means to emit pulse-modulated light.

40. (NEW) The apparatus according to claim 36, wherein said means for emitting light is means to emit a light beam crossing said plane.

41. (NEW) The apparatus according to claim 36, wherein said light-reflective means comprises a substantially triangular zone having light reflectivity, said three locations being defined respectively by the three corners of the triangular zone.

42. (NEW) The apparatus according to claim 41, wherein said means responsive to said signals comprises means responsive to relative amplitude of the signals.

43. (NEW) The apparatus according to claim 36, wherein said means responsive to the light reflected within said plane comprises light-sensing means and means defining a slit aperture for limiting the angular extent to which said reflected light is incident on the sensing means.

44. (NEW) The apparatus according to claim 43, wherein said angular extent is at least 5 degrees in the plane of the slit-length and 1 degree at most normal to that plane.

45. (NEW) The apparatus according to claim 36, wherein said detection means defines first and second mutually-inclined detection planes that are both transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said detection means comprising light-source means for emitting light for reflection within said first and second planes from said locations during movement of said object through the respective first and second planes, first sensing means responsive to the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, second sensing means responsive to the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said apparatus includes means for providing comparison between the first and second signals.

46. (NEW) The apparatus according to claim 45, wherein the means for providing comparison between the first and second signals derives representations of speed of movement and of orientation of said object from the comparison.

47. (NEW) The apparatus according to claim 36, wherein said detection means defines first and second coplanar detection planes transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said first and second detection planes overlapping one another and said detection means comprising light-source means for emitting light for reflection within said first and second

planes from said locations during movement of said object through the respective first and second planes, first sensing means responsive to the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, second sensing means responsive to the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said apparatus includes means for providing comparison between the first and second signals.

48. (NEW) The apparatus according to claim 47, wherein said comparison is between waveforms of the first and second signals to derive representation of orientation of said object.

49. (NEW) Golf-swing analyzer apparatus for providing an output dependent on the orientation of a golf-club head during swing of the club by a golfer, comprising:

(a) means defining a region through which the golfer may swing the golf club in a predetermined direction;

(b) light-reflective means for attachment to the golf-club head to define three reference locations of the head spaced from one another in said direction of swing, each of the three locations being displaced from alignment with the other two locations;

(c) detection means for defining within said region a detection plane transverse to said direction for responding to movement of said light-reflective means through said plane, said detection means comprising:

(i) means for emitting light transversely of said direction for reflection within said plane from said locations during swing of the golf-club head through said plane, and

(ii) means responsive to the light reflected within said plane from said locations to derive electric signals in accordance with movement through said plane of the three locations respectively; and

(d) means responsive to said signals relative to one another for providing said output.

50. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said means responsive to said signals is means responsive to the timing of said signals relative to one another to provide representation of orientation and speed of movement of the golf-club head during said swing.

51. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said means for emitting light comprises means to emit pulse-modulated light, and said means responsive to reflected light comprises means responsive selectively to pulse-modulated reflected light.

52. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said means for emitting light is means to emit a light beam crossing said plane.

53. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said light-reflective means comprises a substantially triangular light-reflective area of the club-head, said three locations being defined respectively by the three corners of the triangular area.

54. (NEW) The golf-swing analyzer apparatus according to claim 53, wherein said means responsive to said signals comprises means responsive to relative amplitude of the signals.

55. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said means responsive to the light reflected within said plane comprises light-sensing means and means defining a slit aperture for limiting the angular extent to which said reflected light is incident on the sensing means.

56. (NEW) The golf-swing analyzer apparatus according to claim 55, wherein said angular extent is at least 5 degrees in the plane of the slit-length and 1 degree at most normal to that plane.

57. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said detection means defines first and second mutually-inclined detection planes that are both transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said detection means comprising light-source means for emitting light for reflection within said first and second planes from said

locations during movement of said head through the respective first and second planes, first sensing means responsive to the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, second sensing means responsive to the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said apparatus includes means for providing comparison between the first and second signals.

58. (NEW) The golf-swing analyzer apparatus according to claim 57, wherein said comparison is between waveforms of the first and second signals to derive representation of orientation of said head.

59. (NEW) The golf-swing analyzer apparatus according to claim 49, wherein said detection means defines first and second coplanar detection planes transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said first and second detection planes overlapping one another and said detection means comprising light-source means for emitting light for reflection within said first and second planes from said locations during movement of said head through the respective first and second planes, first sensing means responsive to the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, second sensing means responsive to the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said apparatus includes means for providing comparison between the first and second signals.

60. (NEW) The golf-swing analyzer apparatus according to claim 59, wherein said comparison is between waveforms of the first and second signals to derive representation of orientation of said head.

61. (NEW) A method for providing an output dependent on the orientation of a moving object relative to its direction of movement, comprising:

(a) a first step of attaching light-reflective means to said object, said light-reflective means being attached to said object to define three reference locations of the object spaced from one another in said direction, and each of the three locations being displaced from alignment with the other two locations;

(b) a second step of defining a detection plane transverse to said direction for responding to movement of said light-reflective means through said plane, said second step comprising:

(i) emitting light transversely of said direction for reflection within said plane from said locations during movement of said object through said plane; and

(ii) responding to light reflected within said plane from said locations to provide electric signals in accordance with movement through said plane of the three locations respectively; and

(c) a third step of analysis of said signals for providing said output.

62. (NEW) The method according to claim 61, wherein said analysis of said signals comprises responding to the timing of said signals relative to one another to provide representation of speed of movement and orientation of said object.

63. (NEW) The method according to claim 61, wherein the light emitted transversely of said direction is pulse-modulated light.

64. (NEW) The method according to claim 61 wherein the light is emitted to cross said plane.

65. (NEW) The method according to claim 61, wherein said light-reflective means comprises a substantially triangular zone having light reflectivity, said three locations being defined respectively by the three corners of the triangular zone.

66. (NEW) The method according to claim 61, wherein said third step includes comparison of the amplitudes of the signals.

67. (NEW) The method according to claim 61, wherein said detection plane has an angular extent of at least 5 degrees and thickness of 1 degree at most.

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68. (NEW) The method according to claim 61, wherein said second step comprises a definition-step for defining first and second mutually-inclined detection planes that are both transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said definition-step comprising emitting light for reflection within said first and second planes from said locations during movement of said object through the respective first and second planes, sensing the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, and sensing the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said third step comprises comparison of the first and second signals with one another for providing said output.

69. (NEW) The method according to claim 68, wherein representations of speed of movement and of orientation of said object are derived from the comparison.

70. (NEW) The method according to claim 61, wherein said second step is a definition-step for defining first and second coplanar detection planes transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said first and second detection planes overlapping one another, and wherein said definition-step comprises emitting light for reflection within said first and second planes from said locations during movement of said object through the respective first and second planes, sensing the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, and sensing the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said third step comprises comparison of the first and second signals with one another for providing said output.

71. (NEW) The method according to claim 70, wherein said comparison is between waveforms of the first and second signals to derive representation of orientation of said object.

72. (NEW) A method for analyzing the orientation of the head of a golf club during swing of the golf-club by a golfer, comprising:

- (a) a first step of defining a region through which the golfer may swing the golf club in a predetermined direction;
- (b) a second step of providing light-reflective means on the golf-club head to define three reference locations of the head spaced from one another in said direction, each of the three locations being displaced from alignment with the other two locations;
- (c) a third step of defining a detection plane transverse to said direction within said region for responding to movement of said light-reflective means through said plane, said third step comprising:
 - (i) emitting light transversely of said direction for reflection within said plane from said locations during swing of the golf club through said plane, and
 - (ii) responding to light reflected within said plane from said locations to derive electric signals in accordance with movement through said plane of the three locations respectively; and
- (d) a fourth step of analysis of said signals, said fourth step including determining the relative timing of the signals.

73. (NEW) The method according to claim 72, wherein said analysis of said signals comprises responding to the timing of said signals relative to one another to provide representation of speed of movement and orientation of the head.

74. (NEW) The method according to claim 72, wherein the light emitted transversely of said direction is pulse-modulated light.

75. (NEW) The method according to claim 72, wherein the light is emitted to cross said plane.

76. (NEW) The method according to claim 72, wherein said light-reflective means comprises a substantially triangular zone having light reflectivity, said three locations being defined respectively by the three corners of the triangular zone.

77. (NEW) The method according to claim 72, wherein said third step includes comparison of the amplitudes of the signals.

78. (NEW) The method according to claim 72, wherein said detection plane has an angular extent of at least 5 degrees and thickness of 1 degree at most.

79. (NEW) The method according to claim 72, wherein said second step comprises a definition-step for defining first and second mutually-inclined detection planes that are both transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said definition-step comprising emitting light for reflection within said first and second planes from said locations during movement of said head through the respective first and second planes, sensing the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, and sensing the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second plane of the three locations respectively, and wherein said third step comprises comparison of the first and second signals with one another for providing said output.

80. (NEW) The method according to claim 79, wherein representations of speed of movement and of orientation of said head are derived from the comparison.

81. (NEW) The method according to claim 72, wherein said second step is a definition-step for defining first and second coplanar detection planes transverse to said direction for responding to movement of said light-reflective means through said first and second detection planes respectively, said first and second detection planes overlapping one another, and wherein said definition-step comprises emitting light for reflection within said first and second planes from said locations during swing of said head through the respective first and second planes, sensing the light reflected within said first plane from said locations to derive first electric signals in accordance with movement through said first plane of the three locations respectively, and sensing the light reflected within said second plane from said locations to derive second electric signals in accordance with movement through said second

plane of the three locations respectively, and wherein said third step comprises comparison of the first and second signals with one another for providing said output.

82. (NEW) The method according to claim 81, wherein said comparison is between waveforms of the first and second signals to derive representation of orientation of said head.